

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A method for ~~shaping or forging~~ workpieces by use of a ~~shaping-forging~~ machine ~~(1)~~ having at least one shaping tool, wherein:

- a) during the machining process, a workpiece is handled by means of at least one handling device ~~(3)~~;
- b) before machining of workpiece(s) on the ~~shaping-forging~~ machine ~~(1)~~ using the tool ~~(2)~~, the position and/or orientation of the tool ~~(2)~~ is determined by the fact that:
 - b1) a detection device ~~(3, 4, 4')~~ approaches one or more predetermined reference surfaces ~~(5, 6, 7, 8, 9, 10)~~ on the tool ~~(2)~~ and detects at least one position on the one or more reference surface(s);
 - b2) signals or data corresponding to the detected position(s) of the reference surface(s) ~~(5, 6, 7, 8, 9, 10)~~ from the detection device are transmitted to an evaluating means ~~(11)~~; and
 - b3) from the signals or data from the detection device about the position(s) of the reference surface(s), the evaluating means ~~(11)~~ determines the position and/or orientation of the tool ~~(2)~~; and
- c) the at least one handling device ~~(3)~~ handles the workpiece(s) based on the determination of the position and/or orientation of the tool ~~(2)~~ by the evaluating means ~~(11)~~.

2-26 (Cancelled).

27. (Currently Amended) A method for ~~shaping or~~ forging workpieces using a ~~shaping~~ forging machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a ~~shaping~~ forging machine, determining a position and/or orientation of at least one shaping tool of the ~~shaping~~ forging machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device.

28. (Previously Presented) The method as recited in claim 27, wherein the detection device comprises the at least one handling device equipped with at least one sensor.

29. (Previously Presented) The method as recited in claim 28, wherein the at least one handling device of the detection device is also used as a handling device for handling the one or more workpieces.

30. (Previously Presented) The method as recited in claim 27, further comprising the evaluating means calculating a position of a coordinate system or reference system of each at least one handling device from the detected at least one position by use of translation imaging and/or rotary imaging.

31. (Previously Presented) The method as recited in claim 30, further comprising, using the detected at least one position, performing at least one of:

- (i) detecting at least three points in space; or
- (ii) for the coordinate system or reference system, detecting at least three points of the at least one handling device for handling the one or more workpieces.

32. (Previously Presented) The method as recited in claim 27, wherein the detection device detects at least two positions or points of the one or more predetermined reference surfaces by scanning the one or more predetermined reference surfaces.

33. (Previously Presented) The method as recited in claim 27, wherein the detection device approaches at least three reference surfaces on the at least one shaping tool, preferably in a predetermined sequence, and in each case precisely detects one position or one point on each of the one or more predetermined reference surfaces.

34. (Previously Presented) The method as recited in claim 27, further comprising, using a plurality of detected positions of the one or more predetermined reference surfaces, performing at least one of:

- (i) determining a reference plane in space; or
- (ii) for a coordinate system or reference system, determining a reference plane of at least one handling device for handling the workpiece.

35. (Previously Presented) The method as recited in claim 34, wherein the reference plane in space, or, for the coordinate system or reference system, the reference plane of at least one handling device for handling the workpieces, is determined from:

- (i) two positions of the one or more predetermined surfaces; and
- (ii) predetermined, additional linearly-independent information about a plane that is parallel to the reference plane.

36. (Previously Presented) The method as recited in claim 27, wherein the detection device or the at least one handling device for the detection device approaches the one or more predetermined reference surfaces on the at least one shaping tool from one or more predetermined starting points.

37. (Previously Presented) The method as recited in claim 36, wherein the one or more predetermined starting points are located in a configuration relative to one another that corresponds to a configuration relative to one another for the one or more predetermined reference surfaces on the at least one shaping tool.

38. (Previously Presented) The method as recited in claim 27, further comprising:

after replacing the at least one shaping tool with a new shaping tool, determining a position and/or orientation of the new shaping tool using the detection device and the evaluating means in a learning or calibration step; and

basing the handling of the one or more workpieces on the determined position and/or orientation of the new shaping tool.

39. (Previously Presented) The method as recited in claim 38, further comprising, prior to determining the position and/or orientation of the new shaping tool, testing at least one detection device or one or more sensors thereof by approaching, with the detection device, a test surface on a tool mounting of the new shaping tool.

40. (Previously Presented) The method as recited in claim 39, further comprising:

identifying an irregularity in the evaluating means when testing the at least one detection device; and

issuing an alarm signal.

41. (Currently Amended) A device configured for ~~shaping or~~ forging workpieces, comprising:

- a) at least one ~~shaping~~ forging machine;
- b) at least one handling device for handling one or more workpieces;
- c) at least one detection device;
- d) one or more predetermined reference surfaces on a shaping tool of the ~~shaping~~ forging machine, wherein the at least one of the one or more predetermined reference surfaces is positioned to be scanned or recognized by the at least one detection device; and
- e) an evaluating means configured to determine a position and/or orientation of the shaping tool from information transmitted by the detection device.

42. (Previously Presented) The device as recited in claim 41, wherein the at least one detection device further comprises the at least one handling device being equipped with at least one sensor, wherein the at least one sensor is any one or more of a contacting sensor, a non-contacting sensors, a proximity switch or sensor, an ultrasound sensor, a short-circuiting switch, or a contact switch.

43. (Previously Presented) The device as recited in claim 42, wherein the at least one the handling device for the detection device further comprises a position measurement system for determining the position of the at least one sensor in space.

44. (Previously Presented) The device as recited in claim 42, wherein the at least one handling device further comprises a gripper for gripping the one or more workpieces, and at least one sensor located in the vicinity of the gripper.

45. (Previously Presented) The device as recited in claim 41, wherein:

- (i) the one or more predetermined reference surfaces on the at least one shaping tool are designed as flat surfaces; and
- (ii) at least two of the one or more predetermined reference surfaces are oriented substantially at right angles relative to one or more of:
 - 1. one another; or
 - 2. at least one test surface with which a function of the at least one handling device and/or at least one sensor can be tested.

46. (Cancelled)

47. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces;

b4) the evaluating means calculating a position of a coordinate system or reference system of each at least one handling device from the detected at least one position by use of translation imaging and/or rotary imaging; and

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device.

48. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces;

b4) the evaluating means calculating a position of a coordinate system or reference system of each at least one handling device from the detected at least one position by use of translation imaging and/or rotary imaging;

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device; and

d) using the detected at least one position, performing at least one of:

(d1) detecting at least three points in space; or

(d2) for the coordinate system or reference system, detecting at least three points of the at least one handling device for handling the one or more workpieces.

49. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces;

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device; and

d) using a plurality of detected positions of the one or more predetermined reference surfaces, performing at least one of:

(d1) determining a reference plane in space; or

(d2) for a coordinate system or reference system, determining a reference plane of at least one handling device for handling the workpiece.

50. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces;

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device; and

d) using a plurality of detected positions of the one or more predetermined reference surfaces, performing at least one of:

(d1) determining a reference plane in space; or

(d2) for a coordinate system or reference system, determining a reference plane of at least one handling device for handling the workpiece;

wherein the reference plane in space, or, for the coordinate system or reference system, the reference plane of at least one handling device for handling the workpieces, is determined from:

two positions of the one or more predetermined surfaces; and

predetermined, additional linearly-independent information about a plane that is parallel to the reference plane.

51. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device;

wherein the detection device or the at least one handling device for the detection device approaches the one or more predetermined reference surfaces on the at least one shaping tool from one or more predetermined starting points.

52. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device;

wherein the detection device or the at least one handling device for the detection device approaches the one or more predetermined reference surfaces on the at least one shaping tool from one or more predetermined starting points;

wherein the one or more predetermined starting points are located in a configuration relative to one another that corresponds to a configuration relative to one another for the one or more predetermined reference surfaces on the at least one shaping tool.

53. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces;

c) testing at least one detection device or one or more sensors thereof by approaching, with the detection device, a test surface on a tool mounting of the new shaping tool; and

d) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device.

54. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces;

c) testing at least one detection device or one or more sensors thereof by approaching, with the detection device, a test surface on a tool mounting of the new shaping tool;

(c1) identifying an irregularity in the evaluating means when testing the at least one detection device;

(c2) issuing an alarm signal; and

d) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device.

55. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device, wherein the at least one handling device includes at least one sensor comprising any one or more of a contacting sensor, a non-contacting sensor, a proximity switch or sensor, an ultrasound sensor, a short-circuiting switch, or a contact switch;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device.

56. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device, wherein the at least one handling device includes:

at least one sensor comprising any one or more of a contacting sensor, a non-contacting sensor, a proximity switch or sensor, an ultrasound sensor, a short-circuiting switch, or a contact switch; and

a position measurement system for determining the position of the at least one sensor in space;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device.

57. (New) A method for shaping or forging workpieces using a shaping machine having at least one shaping tool, comprising:

a) handling one or more workpieces during a machining process with at least one handling device, wherein the at least one handling device includes:

at least one sensor comprising any one or more of a contacting sensor, a non-contacting sensor, a proximity switch or sensor, an ultrasound sensor, a short-circuiting switch, or a contact switch; and

a gripper for gripping the one or more workpieces, and at least one sensor located in the vicinity of the gripper;

b) prior to machining the workpiece on a shaping machine, determining a position and/or orientation of at least one shaping tool of the shaping machine by:

b1) approaching one or more predetermined reference surfaces on the at least one shaping tool with a detection device, thereby detecting at least one position of one or more of the one or more predetermined reference surfaces;

b2) transmitting to an evaluating means information from the detection device corresponding to the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

b3) the evaluating means determining the position and/or orientation of the at least one shaping tool from the transmitted information regarding the detected at least one position of the one or more of the one or more predetermined reference surfaces; and

c) using the determined position and/or orientation of the at least one shaping tool as a basis for handling the one or more workpieces by the at least one handling device.